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DDC International A/S, DACS VAX/VMS to 68020 Bare Cross Compiler System, Version 4.6, Gaithersburg, MD, microVAX 3100 running VMS Version 5.3(Host) to MOTOROLA MVME133 board (Target), ACVC 1.11.

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DDC International A/S

DACS VAX/VMS to 68020 Bare Cross Compiler System, Version 4.6
microVAX 3100 => MOTOROLA MVME133

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A-1

AVF Control Number: NIST90DDC500_2_1.11

Certificate Information

The following Ada implementation was tested and determined to pass ACVC 1.11. Testing was completed on November 29, 1990.

Compiler Name and Version: DACS VAX/VMS to 68020 Bare Cross
Compiler System Version 4.6

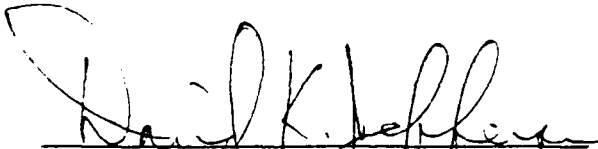
Host Computer System: microVAX 3100 running VMS Version
5.3

Target Computer System: MOTOROLA MVME133 board


A more detailed description of this Ada implementation is found in section 3.1 of this report.

As a result of this validation effort, Validation Certificate 901129S1.11051 is awarded to DDC International A/S. This certificate expires on March 01, 1993.

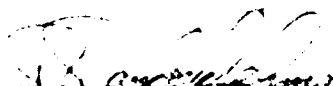
This report has been reviewed and is approved.



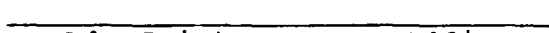
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DECLARATION OF CONFORMANCE

The following declaration of conformance was supplied by the customer.

DECLARATION OF CONFORMANCE

Customer and Certificate Awardee: DDC International A/S

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Technology
National Computer Systems Laboratory
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ACVC Version: 1.11

Ada Implementation:


Compiler Name and Version: DACS. VAX/VMS to 68020 Bare Cross
Compiler System Version 4.6

Host Computer System: microVAX 3100 running VMS Version
5.3

Target Computer System: MOTOROLA MVME133 board

Declaration:

[I/we] the undersigned, declare that [I/we] have no knowledge of deliberate deviations from the Ada Language Standard ANSI/MIL-STD-1815A ISO 8652-1987 in the implementation listed above.


Customer Signature
Company
Title

11/20/1987
Date

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CHAPTER 1

INTRODUCTION

The Ada implementation described above was tested according to the Ada Validation Procedures [Pro90] against the Ada Standard [Ada83] using the current Ada Compiler Validation Capability (ACVC). This Validation Summary Report (VSR) gives an account of the testing of this Ada implementation. For any technical terms used in this report, the reader is referred to [Pro90]. A detailed description of the ACVC may be found in the current ACVC User's Guide [UG89].

1.1 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the Ada Certification Body may make full and free public disclosure of this report. In the United States, this is provided in accordance with the "Freedom of Information Act" (5 U.S.C. #552). The results of this validation apply only to the computers, operating systems, and compiler versions identified in this report.

The organizations represented on the signature page of this report do not represent or warrant that all statements set forth in this report are accurate and complete, or that the subject implementation has no nonconformities to the Ada Standard other than those presented. Copies of this report are available to the public from the AVF which performed this validation or from:

National Technical Information Service
5285 Port Royal Road
Springfield VA 22161

Questions regarding this report or the validation test results should be directed to the AVF which performed this validation or to:

Ada Validation Organization
Institute for Defense Analyses
1801 North Beauregard Street
Alexandria VA 22311

1.2 REFERENCES

[Ada83] Reference Manual for the Ada Programming Language,
ANSI/MIL-STD-1815A, February 1983 and ISO 8652-1987.

[Pro90] Ada Compiler Validation Procedures, Version 2.1, Ada Joint
Program Office, August 1990.

1.3 ACVC TEST CLASSES

Compliance of Ada implementations is tested by means of the ACVC. The ACVC contains a collection of test programs structured into six test classes: A, B, C, D, E, and L. The first letter of a test name identifies the class to which it belongs. Class A, C, D, and E tests are executable. Class B and class L tests are expected to produce errors at compile time and link time, respectively.

The executable tests are written in a self-checking manner and produce a PASSED, FAILED, or NOT APPLICABLE message indicating the result when they are executed. Three Ada library units, the packages REPORT and SPRT13, and the procedure CHECK_FILE are used for this purpose. The package REPORT also provides a set of identity functions used to defeat some compiler optimizations allowed by the Ada Standard that would circumvent a test objective. The package SPRT13 is used by many tests for Chapter 13 of the Ada Standard. The procedure CHECK_FILE is used to check the contents of text files written by some of the Class C tests for Chapter 14 of the Ada Standard. The operation of REPORT and CHECK_FILE is checked by a set of executable tests. If these units are not operating correctly, validation testing is discontinued. Class B tests check that a compiler detects illegal language usage. Class B tests are not executable. Each test in this class is compiled and the resulting compilation listing is examined to verify that all violations of the Ada Standard are detected. Some of the class B tests contain legal Ada code which must not be flagged illegal by the compiler. This behavior is also verified.

Class L tests check that an Ada implementation correctly detects violation of the Ada Standard involving multiple, separately compiled units. Errors are expected at link time, and execution is attempted.

In some tests of the ACVC, certain macro strings have to be replaced by implementation-specific values -- for example, the largest integer. A list of the values used for this implementation is provided in Appendix A. In addition to these anticipated test modifications, additional changes may be required to remove unforeseen conflicts between the tests and implementation-dependent characteristics. The modifications required for this implementation are described in section 2.3.

For each Ada implementation, a customized test suite is produced by the AVF. This customization consists of making the modifications described in the preceding paragraph, removing

withdrawn tests (see section 2.1) and, possibly some inapplicable tests (see Section 3.2 and [UG89]).

In order to pass an ACVC an Ada implementation must process each test of the customized test suite according to the Ada Standard.

1.4 DEFINITION OF TERMS

| | |
|---|---|
| Ada Compiler | The software and any needed hardware that have to be added to a given host and target computer system to allow transformation of Ada programs into executable form and execution thereof. |
| Ada Compiler Validation Capability (ACVC) | The means for testing compliance of Ada implementations, Validation consisting of the test suite, the support programs, the ACVC Capability user's guide and the template for the validation summary (ACVC) report. |
| Ada Implementation | An Ada compiler with its host computer system and its target computer system. |
| Ada Validation Facility (AVF) | The part of the certification body which carries out the procedures required to establish the compliance of an Ada implementation. |
| Ada Validation Organization (AVO) | The part of the certification body that provides technical guidance for operations of the Ada certification system. |
| Compliance of an Ada Implementation | The ability of the implementation to pass an ACVC version. |
| Computer System | A functional unit, consisting of one or more computers and associated software, that uses common storage for all or part of a program and also for all or part of the data necessary for the execution of the program; executes user-written or user-designated programs; performs user-designated data manipulation, including arithmetic operations and logic operations; and that can execute programs that modify themselves during execution. A computer system may be a stand-alone unit or may consist of several inter-connected units. |
| Conformity | Fulfillment by a product, process or service of all requirements specified. |

| | |
|------------------------------|---|
| Customer | An individual or corporate entity who enters into an agreement with an AVF which specifies the terms and conditions for AVF services (of any kind) to be performed. |
| Declaration of Conformance | A formal statement from a customer assuring that conformity is realized or attainable on the Ada implementation for which validation status is realized. |
| Host Computer System | A computer system where Ada source programs are transformed into executable form. |
| Inapplicable test | A test that contains one or more test objectives found to be irrelevant for the given Ada implementation. |
| Operating System | Software that controls the execution of programs and that provides services such as resource allocation, scheduling, input/output control, and data management. Usually, operating systems are predominantly software, but partial or complete hardware implementations are possible. |
| Target Computer System | A computer system where the executable form of Ada programs are executed. |
| Validated Ada Compiler | The compiler of a validated Ada implementation. |
| Validated Ada Implementation | An Ada implementation that has been validated successfully either by AVF testing or by registration [Pro90]. |
| Validation | The process of checking the conformity of an Ada compiler to the Ada programming language and of issuing a certificate for this implementation. |
| Withdrawn test | A test found to be incorrect and not used in conformity testing. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains erroneous or illegal use of the Ada programming language. |

CHAPTER 2

IMPLEMENTATION DEPENDENCIES

2.1 WITHDRAWN TESTS

Some tests are withdrawn by the AVO from the ACVC because they do not conform to the Ada Standard. The following 81 tests had been withdrawn by the Ada Validation Organization (AVO) at the time of validation testing. The rationale for withdrawing each test is available from either the AVO or the AVF. The publication date for this list of withdrawn tests is 90-10-12.

| | | | | | |
|---------|---------|---------|---------|---------|---------|
| E28005C | B28006C | C34006D | B41308B | C43004A | C45114A |
| C45346A | C45612B | C45651A | C46022A | B49008A | A74006A |
| C74308A | B83022B | B83022H | B83025B | B83025D | B83026A |
| B83026B | C83041A | B85001L | C97116A | C98003B | BA2011A |
| CB7001A | CB7001B | CB7004A | CC1223A | BC1226A | CC1226B |
| BC3009B | BD1B02B | BD1B06A | AD1B08A | BD2A02A | CD2A21E |
| CD2A23E | CD2A32A | CD2A41A | CD2A41E | CD2A87A | CD2B15C |
| BD3006A | BD4008A | CD4022A | CD4022D | CD4024B | CD4024C |
| CD4024D | CD4031A | CD4051D | CD5111A | CD7004C | ED7005D |
| CD7005E | AD7006A | CD7006E | AD7201A | AD7201E | CD7204B |
| BD8002A | BD8004C | CD9005A | CD9005B | CDA201E | CE2107I |
| CE2117A | CE2117B | CE2119B | CE2205B | CE2405A | CE3111C |
| CE3118A | CE3411B | CE3412B | CE3607B | CE3607C | CE3607D |
| CE3812A | CE3814A | CE3902B | | | |

2.2 INAPPLICABLE TESTS

A test is inapplicable if it contains test objectives which are irrelevant for a given Ada implementation. The inapplicability criteria for some tests are explained in documents issued by ISO and the AJPO known as Ada Issues and commonly referenced in the format AI-dddd. For this implementation, the following tests were inapplicable for the reasons indicated; references to Ada Issues are included as appropriate.

The following 201 tests have floating-point type declarations requiring more digits than SYSTEM.MAX_DIGITS:

| | |
|-----------------------|-----------------------|
| C24113L..Y (14 tests) | C35705L..Y (14 tests) |
| C35706L..Y (14 tests) | C35707L..Y (14 tests) |
| C35708L..Y (14 tests) | C35802L..Z (15 tests) |
| C45241L..Y (14 tests) | C45321L..Y (14 tests) |
| C45421L..Y (14 tests) | C45521L..Z (15 tests) |
| C45524L..Z (15 tests) | C45621L..Z (15 tests) |

C45641L..Y (14 tests)

C46012L..Z (15 tests)

C24113I..K (3 TESTS) USE A LINE LENGTH IN THE INPUT FILE WHICH EXCEEDS 126 CHARACTERS.

The following 21 tests check for the predefined type LONG_INTEGER:

| | | | | |
|---------|---------|---------|---------|---------|
| C35404C | C45231C | C45304C | C45411C | C45412C |
| C45502C | C45503C | C45504C | C45504F | C45611C |
| C45612C | C45613C | C45614C | C45631C | C45632C |
| B52004D | C55B07A | B55B09C | B86001W | C86006C |
| CD7101F | | | | |

C35404D, C45231D, B86001X, C86006E, and CD7101G check for a predefined integer type with a name other than INTEGER, LONG_INTEGER, or SHORT_INTEGER.

C35702A , C35713B, C45423B, B86001T, AND C86006H CHECK FOR THE PREDEFINED TYPE SHORT_FLOAT.

C35713D AND B86001Z CHECK FOR A PREDEFINED FLOATING-POINT TYPE WITH A NAME OTHER THAN FLOAT, LONG_FLOAT, OR SHORT_FLOAT.

C45531M, C45531N, C45531O, C45531P, C45532M, C45532N, C45532O, AND C45532P CHECK FIXED-POINT OPERATIONS FOR TYPES THAT REQUIRE A SYSTEM.MAX_MANTISSA OF 47 OR GREATER.

C45624A CHECKS THAT THE PROPER EXCEPTION IS RAISED IF MACHINE_OVERFLOW IS FALSE FOR FLOATING POINT TYPES WITH DIGITS 5. FOR THIS IMPLEMENTATION, MACHINE_OVERFLOW IS TRUE.

C45624B CHECKS THAT THE PROPER EXCEPTION IS RAISED IF MACHINE_OVERFLOW IS FALSE FOR FLOATING POINT TYPES WITH DIGITS 6. FOR THIS IMPLEMENTATION, MACHINE_OVERFLOW IS TRUE.

C4A013B CONTAINS THE EVALUATION OF AN EXPRESSION INVOLVING 'MACHINE_RADIX APPLIED TO THE MOST PRECISE FLOATING-POINT TYPE. THIS EXPRESSION WOULD RAISE AN EXCEPTION. SINCE THE EXPRESSION MUST BE STATIC, IT IS REJECTED AT COMPILE TIME.

B86001Y CHECKS FOR A PREDEFINED FIXED-POINT TYPE OTHER THAN DURATION.

C96005B CHECKS FOR VALUES OF TYPE DURATION'BASE THAT ARE OUTSIDE THE RANGE OF DURATION. THERE ARE NO SUCH VALUES FOR THIS IMPLEMENTATION.

CD1009C USES A REPRESENTATION CLAUSE SPECIFYING A NON-DEFAULT SIZE FOR A FLOATING-POINT TYPE.

CA2009C, CA2009F, BC3204C, AND BC3205D THESE TESTS INSTANTIATE GENERIC UNITS BEFORE THEIR BODIES ARE COMPILED. THIS IMPLEMENTATION CREATES A DEPENDENCE ON GENERIC UNIT AS ALLOWED BY AI-00408 & AI-00530 SUCH THAT AT THE COMPILATION OF THE GENERIC UNIT BODIES MAKES THE INSTANTIATING UNITS OBSOLETE.

CD2A84A, CD2A84E, CD2A84I..J (2 TESTS), AND CD2A84O USE REPRESENTATION CLAUSES SPECIFYING NON-DEFAULT SIZES FOR ACCESS TYPES.

The following 265 tests check for sequential, text, and direct access files:

| | | | |
|----------------|-----------------|----------------|-----------------|
| CE2102A..C (3) | CE2102G..H (2) | CE2102K | CE2102N..Y (12) |
| CE2103C..D (2) | CE2104A..D (4) | CE2105A..B (2) | CE2106A..B (2) |
| CE2107A..H (8) | CE2107L | CE2108A..H (8) | CE2109A..C (3) |
| CE2110A..D (4) | CE2111A..I (9) | CE2115A..B (2) | |
| CE2120A..B (2) | CE2201A..C (3) | EE2201D..E (2) | CE2201F..N (9) |
| CE2203A | CE2204A..D (4) | CE2205A | CE2206A |
| CE2208B | CE2401A..C (3) | EE2401D | CE2401E..F (2) |
| EE2401G | CE2401H..L (5) | CE2403A | CE2404A..B (2) |
| CE2405B | CE2406A | CE2407A..B (2) | CE2408A..B (2) |
| CE2409A..B (2) | CE2410A..B (2) | CE2411A | CE3102A..C (3) |
| CE3102F..H (3) | CE3102J..K (2) | CE3103A | CE3104A..C (3) |
| CE3106A..B (2) | CE3107B | CE3108A..B (2) | CE3109A |
| CE3110A | CE3111A..B (2) | CE3111D..E (2) | CE3112A..D (4) |
| CE3114A..B (2) | CE3115A | CE3116A | CE3119A |
| EE3203A | EE3204A | CE3207A | CE3208A |
| CE3301A | EE3301B | CE3302A | CE3304A |
| CE3305A | CE3401A | CE3402A | EE3402B |
| CE3402C..D (2) | CE3403A..C (3) | CE3403E..F (2) | CE3404B..D (3) |
| CE3405A | EE3405B | CE3405C..D (2) | CE3406A..D (4) |
| CE3407A..C (3) | CE3408A..C (3) | CE3409A | CE3409C..E (3) |
| EE3409F | CE3410A | CE3410C..E (3) | EE3410F |
| CE3411A | CE3411C | CE3412A | EE3412C |
| CE3413A..C (3) | CE3414A | CE3602A..D (4) | CE3603A |
| CE3604A..B (2) | CE3605A..E (5) | CE3606A..B (2) | |
| CE3704A..F (6) | CE3704M..O (3) | CE3705A..E (5) | CE3706D |
| CE3706F..G (2) | CE3804A..P (16) | CE3805A..B (2) | CE3806A..B (2) |
| CE3806D..E (2) | CE3806G..H (2) | CE3904A..B (2) | CE3905A..C (3) |
| CE3905L | CE3906A..C (3) | CE3906E..F (2) | |

CE2103A..B and CE3107A EXPECT THAT NAME_ERROR IS RAISED WHEN AN ATTEMPT IS MADE TO CREATE A FILE WITH AN ILLEGAL NAME; THIS IMPLEMENTATION DOES NOT SUPPORT THE CREATION OF EXTERNAL FILES AND SO RAISES USE_ERROR.

2.3 TEST MODIFICATIONS

Modifications (see section 1.3) were required for 67 tests.

The following tests were split into two or more tests because this implementation did not report the violations of the Ada Standard in the way expected by the original tests.

| | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| B22003A | B26001A | B26002A | B26005A | B28003A | B29001A | B33301B |
| B35101A | B37106A | B37301B | B37302A | B38003A | B38003B | B38009A |
| B38009B | B55A01A | B61001C | B61001F | B61001H | B61001I | B61001M |
| B61001R | B61001W | B67001H | B83A07A | B83A07B | B83A07C | B83E01C |
| B83E01D | B83E01E | B85001D | B85008D | B91001A | B91002A | B91002B |
| B91002C | B91002D | B91002E | B91002F | B91002G | B91002H | B91002I |
| B91002J | B91002K | B91002L | B95030A | B95061A | B95061F | B95061G |
| B95077A | B97103E | B97104G | BA1001A | BA1101B | BC1109A | BC1109C |
| BC1109D | BC1202A | BC1202F | BC1202G | BE2210A | BE2413A | |

"PRAGMA ELABORATE (REPORT)" has been added at appropriate points in order to solve the elaboration problems for:

C83030C

The value used to specify the collection size has been increased from 256 to 324 take alignment into account for:

CD2A83A

CE2103A..B and CE3107A abort with an unhandled exception when USE_ERROR is raised on the attempt to create an external file (see 2.2). The AVO ruled that these tests are to be graded as inapplicable.

CHAPTER 3

PROCESSING INFORMATION

3.1 TESTING ENVIRONMENT

The Ada implementation tested in this validation effort is described adequately by the information given in the initial pages of this report with the following additional information:

The DACS VAX/VMS to 68020 Bare Cross Compiler System Version 4.6 was executed on the target MOTOROLA MVME 133 board with the following:

- The MC68020
- The MC68881
- One internal timer
- One serial port
- 1MB RAM

For a point of contact for technical information about this Ada implementation system, see:

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Testing of this Ada implementation was conducted at the customer's site by a validation team from the AVF.

3.2 SUMMARY OF TEST RESULTS

An Ada Implementation passes a given ACVC version if it processes each test of the customized test suite in accordance with the Ada Programming Language Standard, whether the test is applicable or inapplicable; otherwise, the Ada Implementation fails the ACVC [Pro90].

For all processed tests (inapplicable and applicable), a result was obtained that conforms to the Ada Programming Language Standard.

| | | |
|---|------|---------|
| a) Total Number of Applicable Tests | 3561 | |
| b) Total Number of Withdrawn Tests | 81 | |
| c) Processed Inapplicable Tests | 528 | |
| d) Non-Processed I/O Tests | 0 | |
| e) Non-Processed Floating-Point Precision Tests | 0 | |
| f) Total Number of Inapplicable Tests | 528 | (c+d+e) |
| g) Total Number of Tests for ACVC 1.11 | 4170 | (a+b+f) |

3.3 TEST EXECUTION

Version 1.11 of the ACVC comprises 4170 tests. When this compiler was tested, the tests listed in section 2.1 had been withdrawn because of test errors. The AVF determined that 528 tests were inapplicable to this implementation. All inapplicable tests were processed during validation testing. In addition, the modified tests mentioned in section 2.3 were also processed.

A magnetic tape containing the customized test suite (see section 1.3) was taken on-site by the validation team for processing. The contents of the magnetic tape were loaded directly onto the host computer.

After the test files were loaded onto the host computer, the full set of tests was processed by the Ada implementation.

The tests were compiled and linked on the host computer system, as appropriate. The executable images were transferred to the target computer system by Digital Equipment Corporation ethernet server system via an RS232 connection to the target board. The results were captured on the host computer system via the same communications process.

Testing was performed using command scripts provided by the

customer and reviewed by the validation team. See Appendix B for a complete listing of the processing options for this implementation. It also indicates the default options. The options invoked explicitly for validation testing during this test were:

/LIST /LIBRARY

The options invoked by default for validation testing during this test were:

/CHECK /CONFIGURATION_FILE = <default file>
/NOPROGRESS /NOSAVE_SOURCE /NOXREF

Test output, compiler and linker listings, and job logs were captured on magnetic tape and archived at the AVF. Selected listings examined on-site by the validation team were also archived.

APPENDIX A

MACRO PARAMETERS

This appendix contains the macro parameters used for customizing the ACVC. The meaning and purpose of these parameters are explained in [UG89]. The parameter values are presented in two tables. The first table lists the values that are defined in terms of the maximum input-line length, which is 126 the value for \$MAX_IN_LEN--also listed here. These values are expressed here as Ada string aggregates, where "V" represents the maximum input-line length.

| Macro Parameter | Macro Value |
|------------------------------|---|
| \$MAX_IN_LEN | 126 |
| \$BIG_ID1 | (1..V-1 => 'A', V => '1') |
| \$BIG_ID2 | (1..V-1 => 'A', V => '2') |
| \$BIG_ID3 | (1..V/2 => 'A') & '3' & (1..V-1-V/2 => 'A') |
| \$BIG_ID4 | (1..V/2 => 'A') & '4' & (1..V-1-V/2 => 'A') |
| \$BIG_INT_LIT | (1..V-3 => '0') & "298" |
| \$BIG_REAL_LIT | (1..V-5 => '0') & "690.0" |
| \$BIG_STRING1 | '"' & (1..V/2 => 'A') & '"' |
| \$BIG_STRING2 | '"' & (1..V-1-V/2 => 'A') & '1' & '"' |
| \$BLANKS | (1..V-20 => ' ') |
| \$MAX_LEN_INT_BASED_LITERAL | "2:" & (1..V-5 => '0') & "11:" |
| \$MAX_LEN_REAL_BASED_LITERAL | "16:" & (1..V-7 => '0') & "F.E:" |
| \$MAX_STRING_LITERAL | '"' & (1..V-2 => 'A') & '"' |

The following table contains the values for the remaining macro parameters.

| Macro Parameter | Macro Value |
|--|-------------------------|
| ACC_SIZE | : 32 |
| ALIGNMENT | : 4 |
| COUNT_LAST | : 2_147_483_647 |
| DEFAULT_MEM_SIZE | : 2_097_152 |
| DEFAULT_STOR_UNIT | : 8 |
| DEFAULT_SYS_NAME | : DACS_68020 |
| DELTA_DOC | : 2#1.0#E-31 |
| ENTRY_ADDRESS | : 16#FF# |
| ENTRY_ADDRESS1 | : 16#FE# |
| ENTRY_ADDRESS2 | : 16#FD# |
| FIELD_LAST | : 35 |
| FILE_TERMINATOR | : ASCII.EM |
| FIXED_NAME | : NO_SUCH_TYPE |
| FLOAT_NAME | : NO_SUCH_TYPE |
| FORM_STRING | : "" |
| FORM_STRING2 | : |
| "CANNOT RESTRICT FILE CAPACITY" | |
| GREATER_THAN_DURATION | : 100_000.0 |
| GREATER_THAN_DURATION_BASE_LAST | : 200_000.0 |
| GREATER_THAN_FLOAT_BASE_LAST | : 1.80141E+38 |
| GREATER_THAN_FLOAT_SAFE_LARGE | : 1.0E308 |
| GREATER_THAN_SHORT_FLOAT_SAFE_LARGE | : 1.0E308 |
| HIGH_PRIORITY | : 24 |
| ILLEGAL_EXTERNAL_FILE_NAME1 | : \NODIRECTORY\FILENAME |
| ILLEGAL_EXTERNAL_FILE_NAME2 | : |
| THIS-FILE-NAME-IS-TOO-LONG-FOR-MY-SYSTEM | |
| INAPPROPRIATE_LINE_LENGTH | : -1 |
| INAPPROPRIATE_PAGE_LENGTH | : -1 |
| INCLUDE_PRAGMA1 | : |
| PRAGMA INCLUDE ("A28006D1.TST") | : |
| INCLUDE_PRAGMA2 | : |
| PRAGMA INCLUDE ("B28006E1.TST") | : |
| INTEGER_FIRST | : -2147483648 |
| INTEGER_LAST | : 2147483647 |
| INTEGER_LAST_PLUS_1 | : 2147483648 |
| INTERFACE_LANGUAGE | : AS |
| LESS_THAN_DURATION | : -75000.0 |
| LESS_THAN_DURATION_BASE_FIRST | : -131073.0 |
| LINE_TERMINATOR | : ASCII.CR |
| LOW_PRIORITY | : 1 |
| MACHINE_CODE_STATEMENT | : |
| AA INSTR'(AA_EXIT_SUBPRGRM,0,0,0,AA INSTR INTG'FIRST,0); | |
| MACHINE_CODE_TYPE | : AA_INSTR |
| MANTISSA_DOC | : 31 |

```

MAX_DIGITS                : 15
MAX_INT                   : 2147483647
MAX_INT_PLUS_1            : 2147483648
MIN_INT                   : -2147483648
NAME                      : NO_SUCH_TYPE_AVAILABLE
NAME_LIST                 : dacs_68020
NAME_SPECIFICATION1       :
    DISK$AWC_2:[CROCKETTL.ACVC.DEVELOPMENT]X2120A.;1
NAME_SPECIFICATION2       :
    DISK$AWC_2:[CROCKETTL.ACVC.DEVELOPMENT]X2120B.;1
NAME_SPECIFICATION3       :
    DISK$AWC_2:[CROCKETTL.ACVC.DEVELOPMENT]X2120C.;1
NEG_BASED_INT             : 16#F000000E#
NEW_MEM_SIZE              : 2097152
NEW_STOR_UNIT             : 8
NEW_SYS_NAME              : OUR_ULTRIX_ADA
PAGE_TERMINATOR           : ASCII.FF
RECORD_DEFINITION         :
    RECORD INSTR_NO:INTEGER;ARG0:INTEGER;ARG1:INTEGER;
    ARG2:INTEGER;ARG3:INTEGER;ARG4:INTEGER;END RECORD;
RECORD_NAME               : AA_INSTR
TASK_SIZE                 : 32
TASK_STORAGE_SIZE         : 1024
TICK                      : 2#1.0#E-14
VARIABLE_ADDRESS          : 16#ffff00#
VARIABLE_ADDRESS1         : 16#ffff20#
VARIABLE_ADDRESS2         : 16#ffff40#
YOUR_PRAGMA               : NOFLOAT

```

APPENDIX B

COMPILATION SYSTEM OPTIONS

The compiler options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to compiler documentation and not to this report.

| <u>QUALIFIER</u> | <u>DESCRIPTION</u> |
|---------------------|---|
| /[NO]CHECK | Suppresses run-time constraint checks. |
| /CONFIGURATION_FILE | Specifies the file used by the compiler. |
| /LIBRARY | Specifies program library used. |
| /[NO]LIST | Writes a source listing on the list file. |
| /OPTIMIZE | Specifies compiler optimization. |
| /[NO]PROGRESS | Displays compiler progress. |
| /[NO]SAVE_SOURCE | Inserts source text in program library. |
| /[NO]XREF | Creates a cross reference listing. |
| /UNIT | Assigns a specific unit number to the compilation (must be free and in a sublibrary). |
| /ADA_RTS | For maintenance purpose. |
| <source-file-spec> | The name of the source file to be compiled. |

LINKER OPTIONS

The linker options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to linker documentation and not to this report.

| <u>QUALIFIER</u> | <u>DESCRIPTION</u> |
|----------------------|-----------------------------------|
| /LIBRARY | The library used in the link. |
| /[NO]WARNINGS | Print warnings. |
| /[NO]STATISTICS | Print statistics. |
| /[NO]VERIFY | Print information about the link. |
| /[NO]FLOAT | Control of co-processor use. |
| /[NO]VECTOR | Interrupt vector description. |
| /[NO]INTERRUPT_STACK | Interrupt stack description. |
| /[NO]MAIN_STACK | Main task stack description. |
| /[NO]TASKS | Number of TCB'S allocated. |
| /DEFAULTS | Default values for tasks. |
| /[NO]INTERRUPT_STACK | Interrupt vector description. |
| /MAIN_TASK | Main task defaults. |
| /[NO]HEAP | Control of memory management. |
| /[NO]EXCEPTIONS | Control of exception management. |
| /BASE | Base address of the link. |
| /RAM | Description of RAM memory. |
| /[NO]ROM | Description of ROM memory. |
| /[NO]ENTRY | Alternative program start label. |
| /[NO]INIT_FILE | Initialization file name. |
| /[NO]OPTION_FILE | Linker option file name. |
| /[NO]KEEP | Do not delete temporary files. |
| /BOOT | Generate a boot module. |
| /[NO]USR_LIBRARY | A user supplied object library. |
| /RTS_STACK_USE | Amount of memory used by RTS. |
| /[NO]ABSOLUTE | Name of absolute file. |
| /UCC_LIBRARY | UCC library name. |
| <unit-name> | The name of the main unit. |

APPENDIX C

APPENDIX F OF THE Ada STANDARD

The only allowed implementation dependencies correspond to implementation-dependent pragmas, to certain machine-dependent conventions as mentioned in Chapter 13 of the Ada Standard, and to certain allowed restrictions on representation clauses. The implementation-dependent characteristics of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this Appendix are to compiler documentation and not to this report. Implementation-specific portions of the package STANDARD, which are not a part of Appendix F, are:

```
package STANDARD is
```

```
type SHORT_INTEGER is range -32_768 .. 32_767;
```

```
type INTEGER is range -2**31 .. 2**31-1;
```

```
type FLOAT is digits 6  
  range -3.402823466385E+38 .. 3.402823466385E+38;
```

```
type LONG_FLOAT is digits 15  
  range -1.7976931348623157E+308 .. 1.7976931348623157E+308;
```

```
type DURATION is delta 2#1.0#E-14 range -131_072.0 .. 131_071.0;
```

```
end STANDARD;
```

This appendix describes the implementation-dependent characteristics of DACS VAX/VMS to 68020 Bare Ada Cross Compiler System required in Appendix F of the Ada Reference Manual (ANSI/MIL-STD-1815A).

F.1 Implementation-Dependent Pragmas

This section describes all implementation defined pragmas.

F.1.1 PRAGMA INTERFACE_SPELLING

```
Format:      pragma      INTERFACE_SPELLING(<subprogram-name>,  
              <string>)
```

Placement: The pragma may be placed as a declarative item.

Restrictions: Pragma `INTERFACE_SPELLING` must be applied to the subprogram denoted by `<subprogram-name>`. The `<string>` must be a string literal.

This pragma allows an Ada program to call routines with a name that is not a legal Ada name, the <string> provides the exact spelling of the name of the procedure.

F.1.2 PRAGMA INITIALIZE

Format: `pragma INITIALIZE(<string literal>)`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

When the pragma is applied the linker will, as part of the initialization code generate a call to the subprogram with the name `<string_literal>`. The call will be performed before the elaboration of the Ada program is initiated, with IPL on 7. If several pragmas INITIALIZE are applied to the same program the routines are called in the elaboration order, if several pragmas INITIALIZE are applied to one compilation unit the routines are called in the order of appearance. If several compilations units apply pragma INITIALIZE to the same routine the routine is called once only.

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F.1.3 PRAGMA RUNDOWN

Format: `pragma RUNDOWN(<string_literal>)`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Similar to `pragma initialize`, but the subprogram is called after the main program have terminated and in the reverse order as for the `pragma INITIALIZE`.

F.1.4 PRAGMA TASKS

Format: `pragma TASKS;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the task attribute. If the code that is interfaced by a `pragma INTERFACE` uses any tasking constructs, the compilation unit must be marked such that the linker includes the tasking kernel in target programs that reference the compilation unit.

F.1.5 PRAGMA FLOAT

Format: `pragma FLOAT;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the float attribute. If the code that is interfaced by a `pragma INTERFACE` uses any floating point co-processor instructions, the compilation unit must be marked such that the linker includes initialization of the floating point co-processor in target programs that reference the compilation unit.

F.1.6 PRAGMA INTERRUPTS

Format: `pragma INTERRUPTS;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the interrupt attribute. If the code that is interfaced by a `pragma INTERFACE` uses any interrupts, the compilation unit must be marked such that the linker include the interrupt handling in target programs that reference the compilation unit.

F.1.7 PRAGMA STORAGE_MANAGER

Format: `pragma STORAGE MANAGER;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the heap attribute. If the code that is interfaced by a `pragma INTERFACE` uses the storage manager, the compilation unit must be marked such that the linker include initialization of the storage manager in target programs that reference the compilation unit.

F.1.8 PRAGMA INTERRUPT_HANDLER

The pragma interrupt handler is defined with two formats.

F.1.8.1 PRAGMA INTERRUPT_HANDLER for Task Entries

Format: `pragma INTERRUPT_HANDLER;`

Placement: The pragma must be placed as the first declarative item in the task specification that it applies to.

Restrictions: The task for which the `pragma INTERRUPT_HANDLER` is applied must fulfill the following requirements:

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- . address clause must be specified for all entries to the task.
- All entries of the task must be single entries with no parameters.
- The entries must not be called from any tasks.
- No other tasks may be specified in the body of the task.
- The body of the task must consist of a single sequence of accept statements for each of the defined interrupts, see below:

```
task body fih is
  -- local simple data declaration, no tasks.
begin
  accept handler1 do
    <statementlist>;
  end handler1;
  accept handler2 do
    <statementlist>;
  end handler2;
end fih;
```

- No other tasking construct than unconditional entry calls may appear in the statement list for the select alternatives. The execution of a statement list must only execute one unconditional entry call.
- Any procedures called from the accept body must not use any tasking constructs at all.
- No heap storage must allocated.
- No exception must be proporgated out of the statement list of the accept alternatives.

If the restrictions described above are not fulfilled, the program is erroneous and the result of the execution unpredictable. The compiler cannot and is not checking all the restrictions, but attempts to perform as many checks of the requirements as possible.

The `PRAGMA_INTERRUPT` handler with no parameters allows the user to implement immediate response to exceptions.

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F.1.8.2 PRAGMA INTERRUPT_HANDLER for Procedures

Format: `pragma INTERRUPT_HANDLER(procedure-name, integer-literal);`

Placement: The pragma must be placed as a declarative item, in the declarative part defining the specification of the immediately after the procedure specification.

Restrictions: The procedure for which `pragma INTERRUPT_HANDLER` applies must fulfill the following restrictions:

- The integer-literal must be in range 0..255, and must not define an interrupt vector entry to which the processor may generate a trap.
- The procedure must not be called anywhere in the application.
- No tasks may be declared in the body of the procedure.
- The only tasking construct that may be used from the body of the procedure is unconditional entry calls. Several unconditional entry calls may appear in the body of the procedure but the execution of the body must only lead to the execution of one.
- Any subprograms called from the procedure must not use any tasking constructs at all.
- The procedure must be parameterless.
- No heap storage must be allocated from the procedure.
- Exception must not be propagated out of the procedure.

If the restrictions described above are not fulfilled the program is erroneous and the result of the execution unpredictable. The compiler cannot and is not checking all the restrictions, but attempts to perform as many checks of the requirements as possible.

The `pragma INTERRUPT_HANDLER` for procedures defines the named subprogram to be an interrupt handler for the interrupt vector entry defined by the integer-literal.

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F.1.9 PRAGMA NOFLOAT

Format: pragma NOFLOAT(task-id)

Placement: The pragma must be placed as a declarative item, in the declarative part defining the task type or object denoted by the task-id.

Restrictions: The task(s) denoted by the task-id must not execute floating-point co-processor instructions.

This pragma informs the compiler and runtime system that the task will not execute floating point co-processor instructions. Consequently the context switch needs not save and restore the state of the floating point co-processor yielding improved performance.

F.2 Implementation-Dependent Attributes

No implementation-dependent attributes are defined.

F.3 Package SYSTEM

The specification for package SYSTEM is as follows:

package SYSTEM is

| | | |
|------------------|----------|------------------------|
| type ADDRESS | is new | INTEGER; |
| subtype PRIORITY | is | INTEGER range 1 .. 24; |
| type NAME | is | (dacs_68020); |
| SYSTEM_NAME: | constant | NAME := dacs_68020; |
| STORAGE_UNIT: | constant | := 8; |
| MEMORY_SIZE: | constant | := 2048 * 1024; |
| MIN_INT: | constant | := -2_147_483_648; |
| MAX_INT: | constant | := 2_147_483_647; |
| MAX_DIGITS: | constant | := 15; |
| MAX_MANTISSA: | constant | := 31; |
| | | |
| FINE_DELTA: | constant | := 2#1.0#E-31; |
| TICK: | constant | := 2#1.0#E-14; |

type interface_language is (AS);

end SYSTEM;

F.4 Representation Clauses

The DACS VAX/VMS to 68020 Cross Compiler fully supports the 'SIZE representation for derived types. The representation clauses that are accepted for non-derived types are described in the following subsections.

F.4.1 Length Clause

Some remarks on implementation dependent behavior of length clauses are necessary:

- When using the SIZE attribute for discrete types, the maximum value that can be specified is 32 bits.
- SIZE is only obeyed for discrete types when the type is a part of a composite object, e.g. arrays or records.
- Using the STORAGE_SIZE attribute for a collection will set an upper limit on the total size of objects allocated in this collection. If further allocation is attempted, the exception STORAGE_ERROR is raised.
- When STORAGE_SIZE is specified in a length clause for a task, the process stack area will be of the specified size.

F.4.2 Enumeration Representation Clauses

Enumeration representation clauses may specify representations in the range of INTEGER'FIRST + 1..INTEGER'LAST - 1.

F.4.3 Record Representation Clauses

When representation clauses are applied to records the following restrictions are imposed:

- if the component is a record or an unpacked array, it must start at a storage unit boundary (8 bits)
- a record occupies an integral number of storage units (words) (even though a record may have fields that only define an odd number of bytes)
- a record may take up a maximum of 2 Gigabits

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- a component must be specified with its proper size (in bits), regardless of whether the component is an array or not.
- if a non-array component has a size which equals or exceeds one storage unit 32-bits the component must start on a storage unit boundary.
- the elements in an array component should always be wholly contained in 32-bits.

If the record type contains components which are not covered by a component clause, they are allocated consecutively after the component with the value. Allocation of a record component without a component clause is always aligned on a storage unit boundary. Holes created because of component clauses are not otherwise utilized by the compiler.

Pragma PACK on a record type will attempt to pack the components not already covered by a representation clause (perhaps none). This packing will begin with the small scalar components and larger components will follow in the order specified in the record. The packing begins at the first storage unit after the components with representation clauses.

F.4.3.1 Alignment Clauses

Alignment clauses for records are implemented with the following characteristics:

- If the declaration of the record type is done at the outermost level in a library package, any alignment is accepted.
- If the record declaration is done at a given static level (higher than the outermost library level, i.e., the permanent area), only word alignments are accepted.
- Any record object declared at the outermost level in a library package will be aligned according to the alignment clause specified for the type. Record objects declared elsewhere can only be aligned on a word boundary. If the record type is associated with a different alignment, an error message will be issued.
- If a record type with an associated alignment clause is used in a composite type, the alignment is required to be one word; an error message is issued if this is not the case.

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F.5 Implementation-Dependent Names for Implementation Dependent Components ~

None defined by the compiler.

F.6 Address Clauses

This section describes the implementation of address clauses and what types of entities may have their address specified by the user.

F.6.1 Objects

Address clauses are supported for scalar and composite objects whose size can be determined at compile time, if the specified address is a literal.

F.6.2 Task Entries

Address clauses are supported for task entries. The following restrictions applies:

- The affected entries must be defined in a task object only, not a task type.
- The entries must be single and parameterless.
- The address specified must not denote an interrupt index which the processor may trap.
- If the interrupt entry executes floating point co-processor instructions the state of the co-processor must be saved prior to execution of any floating point instructions, and restore before the return.

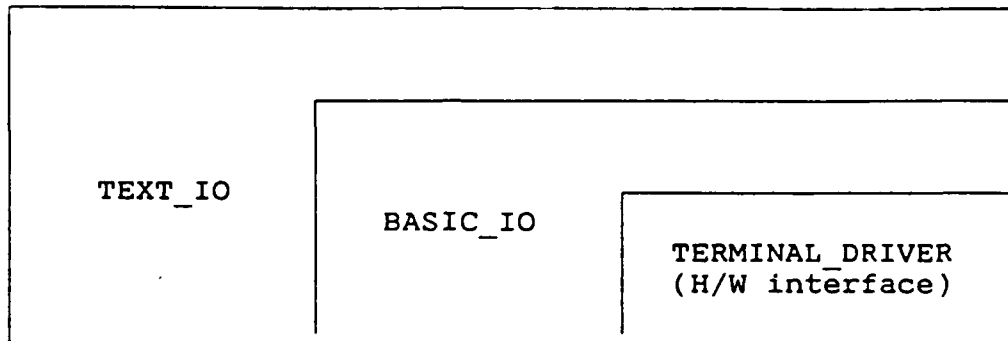
The address specified in the address clause denotes the interrupt vector index.

F.7 Input/Output Packages

In many embedded systems, there is no need for a traditional I/O system, but in order to support testing and validation, DDC-I has developed a small terminal oriented I/O system. This I/O system consists essentially of TEXT_IO adapted with respect to handling only a terminal and not file I/O (file I/O will cause a USE_ERROR

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to be raised) and a low level package called `TERMINAL_DRIVER`. A `BASIC_IO` package has been provided for convenience purposes, forming an interface between `TEXT_IO` and `TERMINAL_DRIVER` as illustrated in the following figure.



The `TERMINAL_DRIVER` package is the only package that is target dependent, i.e., it is the only package that need be changed when changing communications controllers. The actual body of the `TERMINAL_DRIVER` is written in assembly language, but an Ada interface to this body is provided. A user can also call the terminal driver routines directly, i.e. from an assembly language routine. `TEXT_IO` and `BASIC_IO` are written completely in Ada and need not be changed.

`BASIC_IO` provides a mapping between `TEXT_IO` control characters and ASCII as follows:

| TEXT_IO | ASCII Character |
|-----------------|-------------------|
| LINE_TERMINATOR | ASCII.CR |
| PAGE_TERMINATOR | ASCII.FF |
| FILE_TERMINATOR | ASCII.EM (ctrl Z) |
| NEW_LINE | ASCII.LF |

The services provided by the terminal driver are:

- 1) Reading a character from the communications port.
- 2) Writing a character to the communications port.

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F.7.1 Package TEXT_IO

The specification of package TEXT_IO:

```
pragma page;
with BASIC_IO;

with IO_EXCEPTIONS;
package TEXT_IO is

    type FILE_TYPE is limited private;

    type FILE_MODE is (IN_FILE, OUT_FILE);

    type COUNT is range 0 .. INTEGER'LAST;
    subtype POSITIVE_COUNT is COUNT range 1 .. COUNT'LAST;
    UNBOUNDED: constant COUNT:= 0; -- line and page length

    -- max. size of an integer output field 2#....#
    subtype FIELD          is INTEGER range 0 .. 35;

    subtype NUMBER_BASE    is INTEGER range 2 .. 16;

    type TYPE_SET is (LOWER_CASE, UPPER_CASE);

pragma PAGE;
-- File Management
procedure CREATE (FILE   : in out FILE_TYPE;
                  MODE   : in      FILE_MODE :=OUT_FILE;
                  NAME   : in      STRING   :="";
                  FORM   : in      STRING   :=""
                  );

    procedure OPEN  (FILE   : in out FILE_TYPE;
                    MODE   : in      FILE_MODE;
                    NAME   : in      STRING;
                    FORM   : in      STRING   :=""
                    );

    procedure CLOSE (FILE   : in out FILE_TYPE);
    procedure DELETE (FILE   : in out FILE_TYPE);
    procedure RESET (FILE   : in out FILE_TYPE;
                    MODE   : in FILE_MODE);
    procedure RESET (FILE   : in out FILE_TYPE);

    function MODE   (FILE   : in FILE_TYPE) return FILE_MODE;
    function NAME   (FILE   : in FILE_TYPE) return STRING;
    function FORM   (FILE   : in FILE_TYPE) return STRING;

    function IS_OPEN(FILE   : in FILE_TYPE return BOOLEAN;
```

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```
pragma PAGE;
  -- control of default input and output files

  procedure SET_INPUT  (FILE : in FILE_TYPE);
  procedure SET_OUTPUT (FILE : in FILE_TYPE);

  function STANDARD_INPUT  return FILE_TYPE;
  function STANDARD_OUTPUT return FILE_TYPE;

  function CURRENT_INPUT  return FILE_TYPE;
  function CURRENT_OUTPUT return FILE_TYPE;
pragma PAGE;
  -- specification of line and page lengths

  procedure SET_LINE_LENGTH (FILE : in FILE_TYPE;
                             TO : in COUNT);
  procedure SET_LINE_LENGTH (TO : in COUNT);

  procedure SET_PAGE_LENGTH (FILE : in FILE_TYPE;
                             TO : in COUNT);
  procedure SET_PAGE_LENGTH (TO : in COUNT);

  function LINE_LENGTH (FILE : in FILE_TYPE)
    return COUNT;
  function LINE_LENGTH return COUNT;

  function PAGE_LENGTH (FILE : in FILE_TYPE)
    return COUNT;
  function PAGE_LENGTH return COUNT;

pragma PAGE;
  -- Column, Line, and Page Control

  procedure NEW_LINE (FILE : in FILE_TYPE;
                     SPACING : in POSITIVE_COUNT := 1);
  procedure NEW_LINE (SPACING : in POSITIVE_COUNT := 1);

  procedure SKIP_LINE (FILE : in FILE_TYPE;
                      SPACING : in POSITIVE_COUNT := 1);
  procedure SKIP_LINE (SPACING : in POSITIVE_COUNT := 1);

  function END_OF_LINE (FILE : in FILE_TYPE) return BOOLEAN;
  function END_OF_LINE return BOOLEAN;

  procedure NEW_PAGE (FILE : in FILE_TYPE);
  procedure NEW_PAGE;

  procedure SKIP_PAGE (FILE : in FILE_TYPE);
  procedure SKIP_PAGE;

  function END_OF_PAGE (FILE : in FILE_TYPE) return BOOLEAN;
  function END_OF_PAGE return BOOLEAN;
```

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```
function END_OF_FILE (FILE : in FILE_TYPE) return BOOLEAN;
function END_OF_FILE                                     return BOOLEAN;

procedure SET_COL      (FILE : in FILE_TYPE;
                        TO    : in POSITIVE_COUNT);
procedure SET_COL      (TO    : in POSITIVE_COUNT);

procedure SET_LINE     (FILE : in FILE_TYPE;
                        TO    : in POSITIVE_COUNT);
procedure SET_LINE     (TO    : in POSITIVE_COUNT);

function COL           (FILE : in FILE_TYPE)
                        return POSITIVE_COUNT;
function COL           return POSITIVE_COUNT;

function LINE          (FILE : in FILE_TYPE)
                        return POSITIVE_COUNT;
function LINE          return POSITIVE_COUNT;

function PAGE          (FILE : in FILE_TYPE)
                        return POSITIVE_COUNT;
function PAGE          return POSITIVE_COUNT;

pragma PAGE;
-- Character Input-Output

procedure GET  (FILE : in FILE_TYPE; ITEM : out CHARACTER);
procedure GET  (ITEM : out CHARACTER);
procedure PUT  (FILE : in FILE_TYPE; ITEM : in CHARACTER);
procedure PUT  (ITEM : in CHARACTER);

-- String Input-Output

procedure GET  (FILE : in FILE_TYPE; ITEM : out CHARACTER);
procedure GET  (ITEM : out CHARACTER);
procedure PUT  (FILE : in FILE_TYPE; ITEM : in CHARACTER);
procedure PUT  (ITEM : in CHARACTER);

procedure GET_LINE  (FILE : in FILE_TYPE;
                    ITEM : out STRING;
                    LAST : out NATURAL);

procedure GET_LINE  (ITEM : out STRING;
                    LAST : out NATURAL);

procedure PUT_LINE  (FILE : in FILE_TYPE;
                    ITEM : in STRING);
procedure PUT_LINE  (ITEM : in STRING);

pragma PAGE;
-- Generic Package for Input-Output of Integer Types

generic
```

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```
type NUM is range <>;
package INTEGER_IO is

    DEFAULT_WIDTH : FIELD      := NUM'WIDTH;
    DEFAULT_BASE   : NUMBER_BASE :=      10;

    procedure GET (FILE : in FILE_TYPE;
                  ITEM  : out NUM;
                  WIDTH : in FIELD := 0);
    procedure GET (ITEM  : out NUM;
                  WIDTH : in FIELD := 0);

    procedure PUT (FILE : in FILE_TYPE;
                  ITEM  : in NUM;
                  WIDTH : in FIELD := DEFAULT_WIDTH;
                  BASE   : in NUMBER_BASE := DEFAULT_BASE);
    procedure PUT (ITEM  : in NUM;
                  WIDTH : in FIELD := DEFAULT_WIDTH;
                  BASE   : in NUMBER_BASE := DEFAULT_BASE);

    procedure GET (FROM : in STRING;
                  ITEM  : out NUM;
                  LAST  : out POSITIVE);

    procedure PUT (TO : out STRING;
                  ITEM : in NUM;
                  BASE : in NUMBER_BASE := DEFAULT_BASE);

end INTEGER_IO;
```

pragma PAGE;

-- Generic Packages for Input-Output of Real Types

```
generic
    type NUM is digits <>;
package FLOAT_IO is

    DEFAULT_FORE : FIELD :=      2;
    DEFAULT_AFT  : FIELD := NUM'DIGITS - 1;
    DEFAULT_EXP  : FIELD :=      3;

    procedure GET (FILE : in FILE_TYPE;
                  ITEM  : out NUM;
                  WIDTH : in FIELD := 0);
    procedure GET (ITEM  : out NUM;
                  WIDTH : in FIELD := 0);

    procedure PUT (FILE : in FILE_TYPE;
                  ITEM  : in NUM;
                  FORE  : in FIELD := DEFAULT_FORE;
                  AFT   : in FIELD := DEFAULT_AFT;
```

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```

    EXP : in FIELD := DEFAULT_EXP);
procedure PUT (ITEM : in NUM;
    FORE : in FIELD := DEFAULT_FORE;
    AFT  : in FIELD := DEFAULT_AFT;
    EXP  : in FIELD := DEFAULT_EXP);

procedure GET (FROM : in STRING;
    ITEM : out NUM;
    LAST : out POSITIVE);
procedure PUT (TO : out STRING;
    ITEM : in NUM;
    AFT  : in FIELD := DEFAULT_AFT;
    EXP  : in FIELD := DEFAULT_EXP);

end FLOAT_IO;

pragma PAGE;

generic
    type NUM is delta <>;
package FIXED_IO is

    DEFAULT_FORE : FIELD := NUM'FORE;
    DEFAULT_AFT  : FIELD := NUM'AFT;
    DEFAULT_EXP  : FIELD := 0;

    procedure GET (FILE : in FILE_TYPE;
        ITEM : out NUM;
        WIDTH : in FIELD := 0);
    procedure GET (ITEM : out NUM;
        WIDTH : in FIELD := 0);

    procedure PUT (FILE : in FILE_TYPE;
        ITEM : in NUM;
        FORE : in FIELD := DEFAULT_FORE;
        AFT  : in FIELD := DEFAULT_AFT;
        EXP  : in FIELD := DEFAULT_EXP);

    procedure PUT (ITEM : in NUM;
        FORE : in FIELD := DEFAULT_FORE;
        AFT  : in FIELD := DEFAULT_AFT;
        EXP  : in FIELD := DEFAULT_EXP);

    procedure GET (FROM : in STRING;
        ITEM : out NUM;
        LAST : out POSITIVE);

    procedure PUT (TO : out STRING;
        ITEM : in NUM;
        AFT  : in FIELD := DEFAULT_AFT;
        EXP  : in FIELD := DEFAULT_EXP);
```

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```
end FIXED_IO;

pragma PAGE;
  -- Generic Package for Input-Output of Enumeration Types

generic
  type ENUM is (<>);
package ENUMERATION_IO is

  DEFAULT_WIDTH   : FIELD      := 0;
  DEFAULT_SETTING : TYPE_SET := UPPER_CASE;

  procedure GET (FILE : in FILE_TYPE; ITEM : out ENUM);
  procedure GET (ITEM : out ENUM);

  procedure PUT (FILE : FILE_TYPE;
                ITEM : in ENUM;
                WIDTH : in FIELD      := DEFAULT_WIDTH;
                SET   : in TYPE_SET   := DEFAULT_SETTING);
  procedure PUT (ITEM : in ENUM;
                WIDTH : in FIELD      := DEFAULT_WIDTH;
                SET   : in TYPE_SET   := DEFAULT_SETTING);

  procedure GET (FROM : in STRING;
                ITEM : out ENUM;
                LAST : out POSITIVE);

  procedure PUT (TO : out STRING;
                ITEM : in ENUM;
                SET : in TYPE_SET := DEFAULT_SETTING);

end ENUMERATION_IO;

pragma PAGE;
  -- Exceptions

STATUS_ERROR : exception renames IO_EXCEPTIONS.STATUS_ERROR;
MODE_ERROR   : exception renames IO_EXCEPTIONS.MODE_ERROR;
NAME_ERROR   : exception renames IO_EXCEPTIONS.NAME_ERROR;
USE_ERROR    : exception renames IO_EXCEPTIONS.USE_ERROR;
DEVICE_ERROR : exception renames IO_EXCEPTIONS.DEVICE_ERROR;
END_ERROR    : exception renames IO_EXCEPTIONS.END_ERROR;
DATA_ERROR   : exception renames IO_EXCEPTIONS.DATA_ERROR;
LAYOUT_ERROR : exception renames IO_EXCEPTIONS.LAYOUT_ERROR;

pragma page;
private

  type FILE_TYPE is
    record
      FT : INTEGER := -1;
    end record;
```

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```
end record;  
  
end TEXT_IO;
```

F.7.2 Package IO_EXCEPTIONS

The specification of the package IO_EXCEPTIONS:

```
package IO_EXCEPTIONS is  
  
  STATUS_ERROR : exception;  
  MODE_ERROR   : exception;  
  NAME_ERROR    : exception;  
  USE_ERROR     : exception;  
  DEVICE_ERROR  : exception;  
  END_ERROR     : exception;  
  DATA_ERROR   : exception;  
  LAYOUT_ERROR  : exception;  
  
end IO_EXCEPTIONS;
```

F.7.3 Package BASIC_IO

The specification of package BASIC_IO:

```
with IO_EXCEPTIONS;  
  
package BASIC_IO is  
  
  type count is range 0 .. integer'last;  
  
  subtype positive_count is count range 1 .. count'last;  
  
  function get_integer return string;  
  
  -- Skips any leading blanks, line terminators or page  
  -- terminators. Then reads a plus or a minus sign if  
  -- present, then reads according to the syntax of an  
  -- integer literal, which may be based. Stores in item  
  -- returns a string containing an optional sign and an  
  -- integer literal.  
  --  
  -- The exception DATA_ERROR is raised if the sequence  
  -- of characters does not correspond to the syntax  
  -- described above.  
  --
```

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```
-- The exception END_ERROR is raised if the file terminator
-- is read. This means that the starting sequence of an
-- integer has not been met.
--
-- Note that the character terminating the operation must
-- be available for the next get operation.
--
```

```
function get_real return string;
```

```
-- Corresponds to get_integer except that it reads according
-- to the syntax of a real literal, which may be based.
```

```
function get_enumeration return string;
```

```
-- Corresponds to get_integer except that it reads according
-- to the syntax of an identifier, where upper and lower
-- case letters are equivalent to a character literal
-- including the apostrophes.
```

```
function get_item (length : in integer) return string;
```

```
-- Reads a string from the current line and stores it in
-- item. If the remaining number of characters on the
-- current line is less than length then only these
-- characters are returned. The line terminator is not
-- skipped.
```

```
procedure put_item (item : in string);
```

```
-- If the length of the string is greater than the current
-- maximum line (linelength), the exception LAYOUT_ERROR
-- is raised.
--
-- If the string does not fit on the current line a line
-- terminator is output, then the item is output.
```

```
-- Line and page lengths - [DOD-83] 14.3.3.
--
```

```
procedure set_line_length (to : in count);
```

```
procedure set_page_length (to : in count);
```

```
function line_length return count;
```


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```
function page_length return count;

-- Operations on columns, lines and pages - [DOD-83] 14.3.4.
--

procedure new_line;

procedure skip_line;

function end_of_line return boolean;

procedure new_page;

procedure skip_page;

function end_of_page return boolean;

function end_of_file return boolean;

procedure set_col (to      : in      positive_count);

procedure set_line (to      : in      positive_count);

function col return positive_count;

function line return positive_count;

function page return positive_count;

-- Character and string procedures.
-- Corresponds to the procedures defined in [DOD-83] 14.3.6.

procedure get_character (item :      out character);

procedure get_string (item :      out string);

procedure get_line (item :      out string;
```

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```
        last :      out natural);

procedure put_character (item : in      character);

procedure put_string (item : in      string);

procedure put_line (item : in      string);

-- exceptions:

USE_ERROR      : exception renames IO_EXCEPTIONS.USE_ERROR;
DEVICE_ERROR   : exception renames IO_EXCEPTIONS.DEVICE_ERROR;
END_ERROR      : exception renames IO_EXCEPTIONS.END_ERROR;
DATA_ERROR     : exception renames IO_EXCEPTIONS.DATA_ERROR;
LAYOUT_ERROR   : exception renames IO_EXCEPTIONS.LAYOUT_ERROR;

end BASIC_IO;
```

F.7.4 Package TERMINAL_DRIVER

The specification of package TERMINAL_DRIVER:

```
package terminal_driver is

  procedure put_character(ch : character);

  procedure flush;

  function get_character return character;

  procedure purge;

private

  pragma interface (AS, put_character);
  pragma interface_spelling(put_character, "Ada_UCC_GSPutByte");

  pragma interface (AS, get_character);
  pragma interface_spelling(get_character, "Ada_UCC_GSGetByte");

  pragma interface (AS, flush);
  pragma interface_spelling(flush, "Ada_UCC_GSFlushOutput");

  pragma interface (AS, purge);
  pragma interface_spelling(purge, "Ada_UCC_GSPurgeInput");
```

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```
pragma initialize("Ada_UCC_GSInitIO");
pragma rundown   ("Ada_UCC_GSCloseIO");

end terminal_driver;
```

F.7.5 Package SEQUENTIAL_IO

-- Source code for SEQUENTIAL_IO

```
pragma PAGE;

with IO_EXCEPTIONS;

generic

    type ELEMENT_TYPE is private;

package SEQUENTIAL_IO is

    type FILE_TYPE is limited private;

    type FILE_MODE is (IN_FILE, OUT_FILE);

pragma PAGE;
-- File management

    procedure CREATE(FILE : in out FILE_TYPE;
                     MODE : in     FILE_MODE := OUT_FILE;
                     NAME : in     STRING   := "";
                     FORM : in     STRING   := "");

    procedure OPEN  (FILE : in out FILE_TYPE;
                     MODE : in     FILE_MODE;
                     NAME : in     STRING;
                     FORM : in     STRING := "");

    procedure CLOSE (FILE : in out FILE_TYPE);

    procedure DELETE(FILE : in out FILE_TYPE);

    procedure RESET (FILE : in out FILE_TYPE;
                     MODE : in     FILE_MODE);

    procedure RESET (FILE : in out FILE_TYPE);

    function MODE   (FILE : in FILE_TYPE) return FILE_MODE;

    function NAME   (FILE : in FILE_TYPE) return STRING;

    function FORM   (FILE : in FILE_TYPE) return STRING;
```

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```
function IS_OPEN(FILE : in FILE_TYPE) return BOOLEAN;

pragma PAGE;
-- input and output operations

procedure READ (FILE : in FILE_TYPE;
                ITEM : out ELEMENT_TYPE);

procedure WRITE (FILE : in FILE_TYPE;
                 ITEM : in ELEMENT_TYPE);

function END_OF_FILE(FILE : in FILE_TYPE) return BOOLEAN;

pragma PAGE;
-- exceptions

STATUS_ERROR : exception renames IO_EXCEPTIONS.STATUS_ERROR;
MODE_ERROR   : exception renames IO_EXCEPTIONS.MODE_ERROR;
NAME_ERROR   : exception renames IO_EXCEPTIONS.NAME_ERROR;
USE_ERROR    : exception renames IO_EXCEPTIONS.USE_ERROR;
DEVICE_ERROR : exception renames IO_EXCEPTIONS.DEVICE_ERROR;
END_ERROR    : exception renames IO_EXCEPTIONS.END_ERROR;
DATA_ERROR   : exception renames IO_EXCEPTIONS.DATA_ERROR;

pragma PAGE;
private

type FILE_TYPE is new INTEGER;

end SEQUENTIAL_IO;
```

F.8 Machine Code Insertion

Machine code insertion is allowed using the instruction defined in package MACHINE_CODE. All arguments given in the code statement aggregate must be static.

The machine language defined in package MACHINE_CODE is not VAX assembler, but rather Abstract A-code which is an intermediate language used by the compiler.